the effect of such temperatures on the virulence of the typhoid bacillus, Dr. Müller states, but only as the result of very limited experiments, that he could detect no difference in the behaviour in this respect of those kept at 37° and 40° C. respectively.

A MODIFIED centesimal system of subdividing time and angular measures is advocated by M. H. de Sarrauton, in the *Revue Scientifique*. He proposes to retain the hour as a fundamental unit of time, on account of its universal acceptance, its convenience, and the hopelessness of the task of altering it. But the hour should be divided into 100 minutes, and the minute into 100 seconds. Thus each new minute would be three-fifths of an old minute, or thirty-six seconds, while the new second would be a little over a third of the present second. Two of the new seconds would cover the time of a brisk step, like the accelerated pace used in the French army. The new second is the time taken by one semi-vibration of a simple pendulum 12·9 cm. long. Time could then be consistently expressed in hours and decimals. Thus 8·3348 h. might be read 8 hours 33 (new) minutes 48 (new) seconds, and calculations involving time would be much simplified. Clock and watch dials would be subdivided into hours, as usual, but the smaller divisions for the minute and seconds hands would be hundredths of the circle instead of sixtieths, and every tenth division would have to be slightly marked. For angular measurement, M. de Sarrauton proposes 240°, subdivided into 100 minutes of 100 seconds each, so that they could be converted into hours by shifting the decimal point one place to the left.

A FEW particulars of the new mouth of the Vistula are given in the *Globus*. It was made by regulating the old branch going into the Baltic, which was straightened and shortened from ten miles to four and a half, while the channel was broadened by shifting the dyke on the left bank six miles to the west. At the same time, the Danzig branch was cut off by a lock. This useful piece of work will not only make the Vistula more accessible, but will prevent the disastrous floods which caused far-reaching destruction in winter and spring, near the mouth of the river. The work cost a million pounds, half of which was borne by the districts concerned, and half by the German Treasury.

THE current number of the *British Medical Journal* has a note on the vision of School Board children, based upon a report of Dr. James Kerr, medical superintendent of the Bradford School Board. The tests employed were designed to detect every child who had not good distant vision with one eye at least, the list of children thus obtained including those with defect of distant sight from all causes, remediable or otherwise. Such a list having been made, it was an easy matter to more fully examine all the children thus tabulated, and to classify and deal with them as might be necessary. In the report, tables are given showing the number of children examined, and the percentage of defective eyesight in the different standards from one to seven. A perusal of Dr. Kerr's report will, in the opinion of our contemporary, well repay those who have to conduct similar examinations of large numbers of school children.

WE have received from the Deutsche Seewarte (Hamburg) the report of its labours during the year 1894. The duties of this institution differ materially from those of the German Meteorological Institute (Berlin), whose report we lately noticed, inasmuch as the former deals specially with weather prediction and marine meteorology. In both of these branches great activity is shown, and we have frequently referred to the useful work carried on. The detailed discussion of the meteorology of the various oceans, for the benefit of seamen, the preparation of synoptic weather charts of the North Atlantic Ocean, for the advancement of practical meteorology, and the publication of observations taken in remote parts of the world, are noteworthy instances of the industry of the institution. For the purpose of obtaining information relating to maritime meteorology, it has not only established many agencies in German ports, but the Consuls in several foreign ports, including English, also take part in enlisting observers and supplying the necessary registers; the result being that about 450 voluntary observers were co-operating at the end of the year in the mercantile marine alone.

THE annual report of the Department of Mines and Agriculture, New South Wales, for the year 1894, has come to hand. In it reference is made to the resignation of the position of palæontologist of Mr. Robert Etheridge, occasioned by his accepting the curatorship of the Australian Museum. Mr. Etheridge will, however, we are pleased to notice, still retain connection with the department, having, the report says, volunteered to act as honorary consulting palæontologist.

WE have received from the Keeper of the Manchester Museum, Owens College, a new handy guide to the museum, which has been compiled for the purpose of indicating cursorily the principal objects in the building and its general arrangement, for the benefit of visitors whose time is limited. To those who can afford time to pay several visits, the illustrated guide is recommended as being more complete and useful.

THE new part of the *Asclepiad*, Sir B. Ward Richardson's quarterly, contains articles on "Cycling and Heart Disease," "The late prevailing Epidemic," and, with portrait, "John Abernethy, F.R.S."

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus*, ♂ ♀) from India, presented by Mr. Hugh H. Collis; a White-tailed Sea-Eagle (*Haliætus albicilla*) from Northern Russia, presented by Mr. Robert Ashton; two Red-backed Shrikes (*Lanius collurio*), British, presented by Mr. C. Ingram; a Natterjack Toad (*Bufo calamita*) from Surrey, presented by Mr. Hanley Flower; a Melodious Jay Thrush (*Leucodioptron canorum*), deposited, a —— Capuchin (*Cebus ? ♂*), a Porto Rico Pigeon (*Columba corensis*), a Vinaceous Pigeon (*Columba vinacea*), a Barn Owl (*Strix flammea*), seven Adorned Ceratophrys (*Ceratophrys ornata*) from Brazil, purchased; a Great Kangaroo (*Macropus gigantus*, ♂), a Rufous Rat Kangaroo (*Hypsiprymnus rufescens*, ♂), a short-headed Phalanger (*Belideus breviceps*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE FORMS OF JUPITER'S SATELLITES.—A paper, by Mr. S. I. Bailey, on the forms of the discs of Jupiter's satellites, is communicated by Prof. E. C. Pickering to the current *Astrophysical Journal*. A number of observations of the satellites has been made with the thirteen-inch refractor at the Arequipa Observatory; and the results were: "Under the best conditions, that is, with the instrument in perfect adjustment and good seeing, satellites II., III. and IV. were always seen round. Satellite I. was twice seen having an apparent elongation in the same direction as Jupiter. In both cases the satellite was near the planet. On the second occasion, I., when off the disc, but near Jupiter, appeared elongated, but an hour later, plainly seen on the disc of Jupiter, it appeared perfectly round. On the other hand, the shadows of I. and III. on other nights were seen elongated. Several occultations and transits were observed, but the limb of Jupiter was not seen when, to me, it gave any indication of transparency. . . . During the hours given, we failed to detect any systematic change of form in any of the satellites. These observations, scattered through the cloudy season, may not be the best possible, for the same observers and instrument in Arequipa, nevertheless it does not seem probable to me that any frequent periodic recurrence of an ellipticity, approximating in amount that of Jupiter itself, would have escaped detection."

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Ephemeris of Swift's Comet.—The following elements and ephemeris of Swift's comet, the reappearance of which was announced last week, have been computed by Dr. Berberich, and are published in *Edinburgh Circular*, No. 45. The elements are deduced from the observations:—Mount Hamilton, August 21; Nice (M. Juvelle), August 24; Hamburg, August 25.

Another observation of August 23, made by Mr. J. Witt at the Urania Observatory, Berlin, is closely represented by the ephemeris. Dr. Berberich thinks the comet will possibly belong to the group of periodic comets with short revolution.

Elements.

T = 1895, Sept. 3·3630, M.T. Berlin.

$$\left.\begin{aligned}\omega &= 179^{\circ}\ 37'{\cdot}94\\ \Omega &= 172\ \ 59{\cdot}65\\ i &= 4\ \ 38{\cdot}55\end{aligned}\right\}\text{ Mean Equinox 1895·0.}$$

$\log q = 0{\cdot}16537.$

Ephemeris for Berlin Midnight.

1895.	R.A. h. m. s.	Decl. ° ′	log. Δ.	log. *r*.	Brightness.
Sept. 4	1 0 7	+6 17·3			
6	1 4 3	6 18·0	9·7100	0·1656	1·17
8	1 7 50	6 17·5			
10	1 11 28	6 15·9	9·7071	0·1664	1·18
12	1 14 57	6 13·2			
14	1 18 16	6 9 6	9·7062	0·1679	1·18
16	1 21 25	6 5·1			
18	1 24 23	5 59·7	9·7073	0·1700	1·16
20	1 27 11	5 53·6			
22	1 29 49	+5 46·9	9·7107	0·1727	1·16

The brightness at August 21·5 has been taken as unity.

Comets and the Sun-spot Period.—Since the discovery of the periodicity of the sun-spots, investigations have shown that many terrestrial phenomena are, and others may be, closely allied to it. These are generally looked upon as results due to the variation in the sun. If it were found that comets had an eleven-yearly period, we should have the question before us as to whether this period be the result of this period, or whether the period depended to a certain extent on this periodical cometary influx. If the sun, as has been supposed, were fed, so to speak, with cometary matter, then the spot period would naturally be dependent on some external source of supply such as this. But since the solar atmosphere has a circulation which seems now to have been fairly shown to be the cause of this periodicity, such an outward supply of energy is not thought now to be of such importance as would have been the case some years ago. This does not take away the interest, however, from Herr J. Unterweger's investigation concerning the connection of spots and appearances of comets, but would rather instigate it. The author has, by a strict examination of the elements of the larger periodical comets, obtained a function which can be represented mathematically by a formula, and from which an eleven-yearly period since 1740 can be recognised. From the year 1833, also, the maxima and minima points fall together, without exception, with those of the sun-spot curves. In determining the length of the period, the amplitude of the period was set for each series as a function of the length of the period, and then each value for the duration of the period ascertained. The calculation was so arranged that two neighbouring values, which made the amplitude a minimum, were also determined. The values for the function came out as 8·682, 11·226, 13·365 years, those for the series showing the relative number of sun-spots being 8·721, 11·254, 13·424 years.

To determine also whether the points of maxima and minima for the function were coincident with those for the series showing the sun-spot numbers, the curves drawn from the values derived coincided to such an extent that a secondary maximum could be recognised on both of them in similar positions.

Other results which the investigator indicates as having been shown are:—The identification of the thirty-five-yearly sun-spot period, the function giving larger values in 1778, 1816, 1848 and 1882, and smaller minima in 1764, 1806, 1834 and 1867; the time between two successive maxima being in the mean 34·8 years.

The secular period 1764–1806, with maximum at 1777–80, coincides with a secular maximum of sun-spots and a large *gletscherverstors* which began in 1768 and ended about 1785. The 1806-1834 interval, with a maximum at 1816, corresponds to a maximum of sun-spot and to an intense *gletscherverstors* from 1814 to 1824. The third and fourth periods are also likewise explained.

Cases are also made out for the secular variations in the climate, and a suggestion is thrown out that if we may look upon "Kometen als stark elektrische Massen," then at the times of their maximum number and least distances from the earth, small induced currents may be set up, which will be recorded by the magnetic needle; this latter question has not, however, been investigated.

THE SUN'S PLACE IN NATURE.[1]

XI.

The Clock Rate.

The proper regulation of this clock error and consequent "trail" of the spectrum across the plate parallel to itself are essential to the success of photographs taken by the objective prisms. The spectrum of a bright star must obviously be made to trail more quickly than that of a fainter one, and a shorter exposure is sufficient. Since for the same clock error, and in the same time, a star near the pole will give a shorter trail than one nearer the equator, declination must also be taken into account. Keeping a constant clock error, equal widths of spectrum for stars of different declinations may be obtained by lengthening the time of exposure for stars away from the equator, but in that case, the stars near the pole would be over-exposed in relation to those nearer the equator.

The exposure given to stars of equal magnitudes should evidently be the same, no matter in what part of the sky they may be situated, and the clock error should, therefore, be increased in proportion to the secant of the angle of declination.

The light-ratio of stars being $2{\cdot}512^n$, where n expresses the difference in magnitude, the time of exposure must vary in the same proportion, and the clock error in inverse proportion. Thus, where 5 minutes' exposure is sufficient for a first-magnitude star, 31 minutes is required to obtain a fully-exposed spectrum of a star of the third magnitude. This law, however, only applies to photographic magnitudes, and must be modified according to the type of spectrum or the colour of the star.

The red stars, being much weaker in blue and violet rays than the yellow or white stars, require much longer exposures than white stars of equal magnitude. To obtain a spectrum of β Pegasi extending to the K line, for example, at least three times the exposure required by a white star of similar magnitude must be given.

For conveniently adjusting the exposures, tables have been constructed which show at a glance the position of the regulator for a star of given magnitude and declination.

It is obvious that with an instrument of high dispersion, the number of stars it is possible to photograph is very limited, as the long exposures required for the fainter stars are impracticable, and, even if possible, the definition of the lines would be destroyed by atmospheric tremors.

Hence, it is at present only possible to photograph the spectra of the faint stars on a very small scale. With an objective of 8 inches aperture and 44 inches focal length, and a prism of 13° refracting angle, Prof. Pickering has photographed the spectra of stars down to the eighth magnitude. These spectra are about 1 centimetre long, and a millimetre broad, and though they do not show a very great amount of detail, they are sufficient to reveal the type of spectrum.

With an instrument capable of photographing faint stars, a large number of spectra may be taken at one exposure; but, with the instruments of larger dispersion, this is not generally the case, as there are few bright stars of nearly equal magnitude sufficiently close together.

The Electrical Control.

In consequence of the great accuracy required in the driving of the telescope when long exposures are necessary, the 10-inch equatorial has been fitted with a simple and inexpensive form of electrical control. This is a modification of that designed by Mr. Russell, of the Sydney Observatory.[2] The existing driving

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[1] Revised from shorthand notes of a course of Lectures to Working Men at the Museum of Practical Geology during November and December, 1894. (Continued from page 425.)

[2] *Monthly Notices*, vol. li. p. 43, 1890-91.

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